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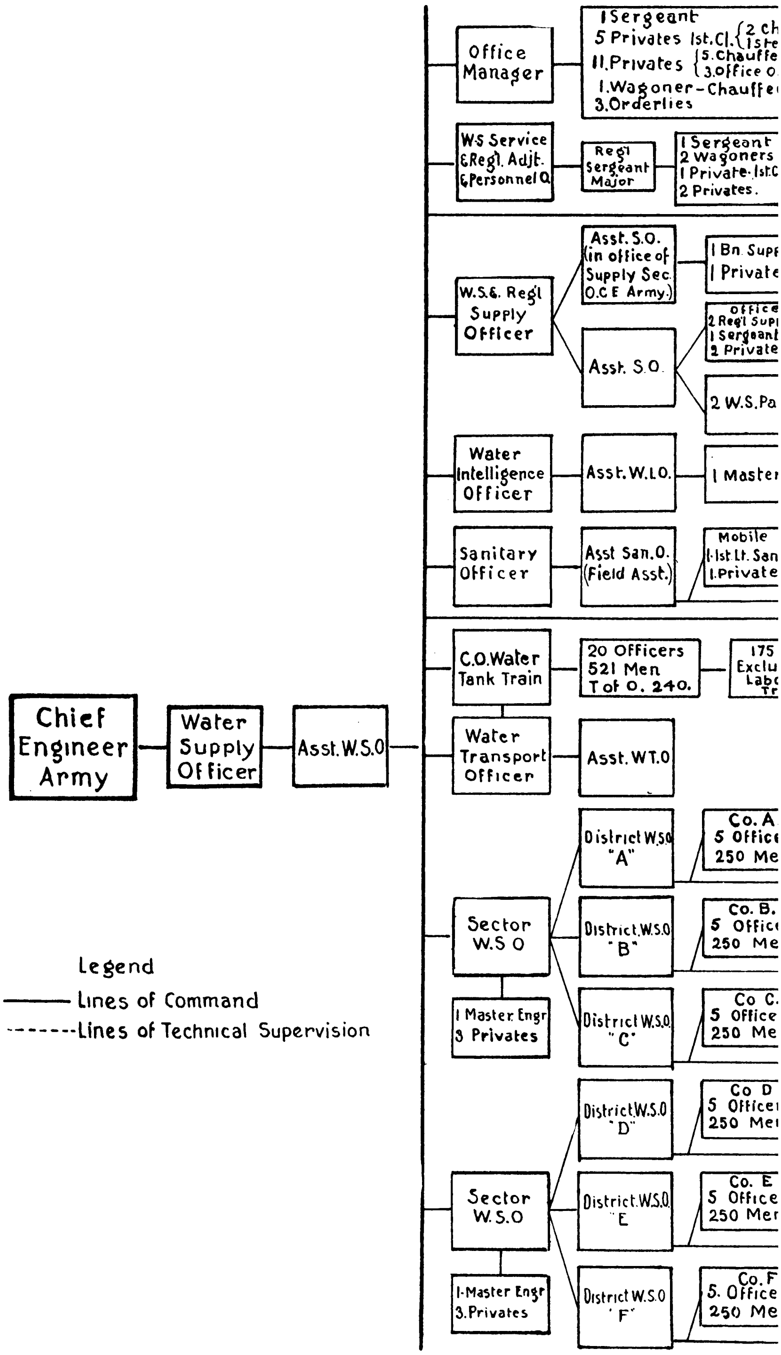
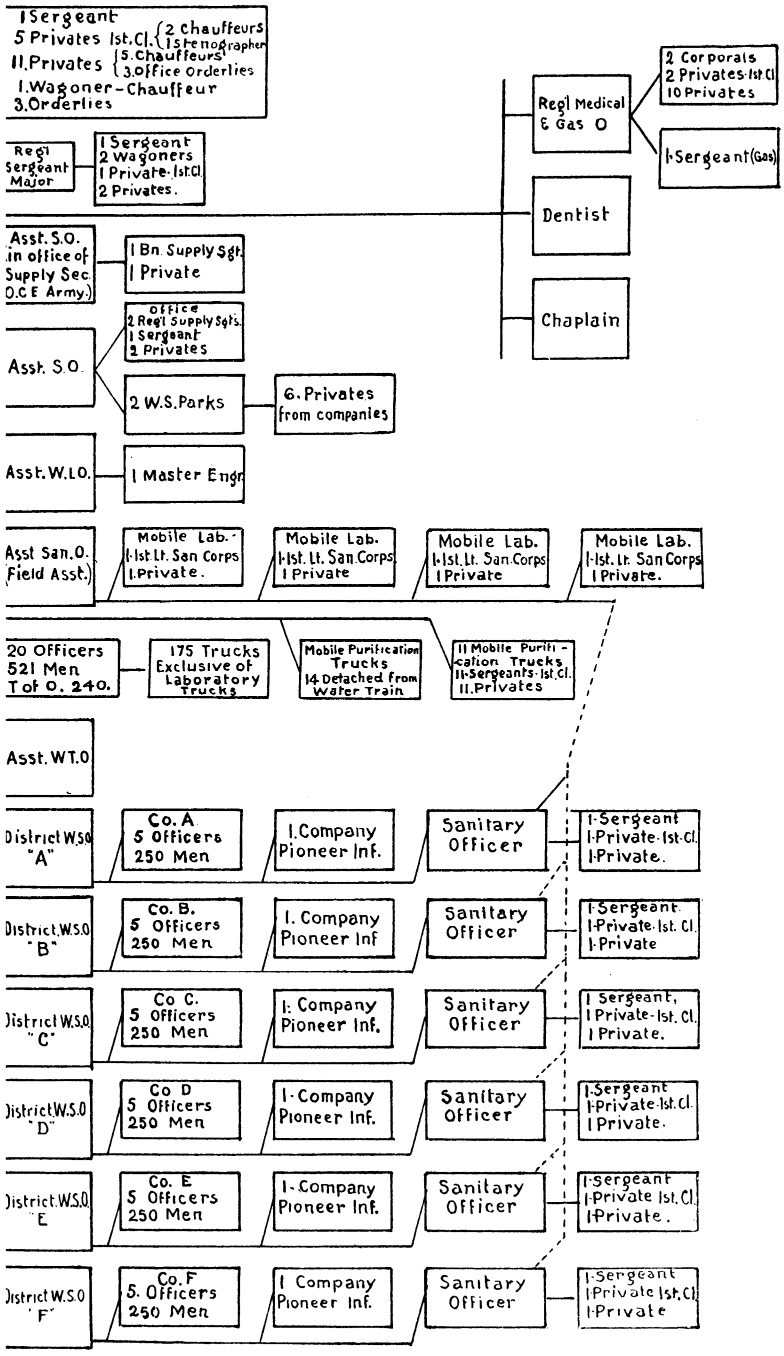


Fig. 1. Organization Chart of the Water Supp



THE WATER SUPPLY SERVICE OF AN ARMY, A. E. F.

KEEPING THE FIRST ARMY SUPPLIED WITH WATER[1]

By. Lieut.-Col. F. W. Scheidenhelm

Ammunition, water, food—all are essential to keep an army in fighting trim. Ammunition is essential for fighting, water and food are essential for *efficient* fighting and for life. The individual soldier or animal feels the lack first of water, then of food. Depending upon the availability of other means of transportation, water was at times given priority over ammunition as regards transportation over the narrow gauge railways at the front.

The problem of water supply at the front is simple in detail. The quantities of water handled at any one place are small. The difficulties are due rather to the extent of territory to be covered and the speed necessary in making supplies available.

Aside from the necessity of having a general familiarity with matters of hydraulics, of having the water supply point of view, so to speak, the engineering work involved is really of elementary character. No reference books were necessary except, perhaps, a table of friction losses in pipe. Executive and organization work, on the other hand, stood out as of prime importance. In fact the water supply work at the front might well be characterized as "rough and ready,"—*rough* because it had to be *ready* for the arrival of certain troops or for some other contingency.

The water supply along the American front was the responsibility of the Water Supply Service of the field armies. The present discussion deals with the work of the Water Supply Service of the American First Army. Its responsibility covered water for men, for animals, for railways, both standard and narrow gauge, and for hospitals, including field and evacuation, but not base, hospitals. Under campaign conditions the Engineer Department of the U. S. Army is responsible for water supply. Under pre-war regulations responsibility for quantity only was contemplated, but under the regulations adopted for the American Expeditionary Forces, the responsibility of the Engineer Department, of which the Water Supply Service formed a part, was extended to include quality also. The responsibility for quality, however, extended only to and including "water points," as will be explained in more detail.

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[1] Revised notes of an informal address at the Buffalo convention, June 12, 1919. The author was in charge of the water supply service of the First Army, A. E. F.

Prior to the recent war such a thing as a Water Supply Service was unknown. It was the great densities of troop concentration that brought into the forefront the need for such a Service. The French in 1915, and soon thereafter the British, were the forerunners in establishing special services for this purpose. Profiting by their experience the American Expeditionary Force prepared in its early stages to set up its own Water Supply Service. What troop density means may perhaps be better appreciated after considering that a common density prior to a great attack involved 100,000 men with, say, 35,000 animals, all crowded into an area having a front of three miles and a depth not exceeding seven miles.

The principal areas involved in the American concentration prior to the St. Mihiel drive supported a pre-war population of about 25,000 civilians. These same areas during the concentration supported a military population of about 600,000 men, together with nearly 200,000 animals. The pre-war water supply was none too ample for parts of the region. In fact, those very parts where troops were to be crowded most densely had but little potable water, especially during the latter part of the summer season. The supply of drinking water in the region, therefore, had to be increased to something like twenty-five times its earlier capacity. Even the four years of military occupation of the area preceding the St. Mihiel drive had resulted in increasing the supply to only about six times the pre-war supply.

The Water Supply Service of the American Expeditionary Forces centered around the 26th Engineers, a regiment especially organized, largely by means of volunteers, for water supply work. A number of its officers were detailed from time to time for headquarters and other staff work. Thus Major (subsequently Colonel) F. F. Longley, a member of this Association, was sent to France in advance of the water supply troops and remained the principal officer of this Service at the headquarters of the Chief Engineer, A. E. F.

The need for water supply troops in France resulted in scattering the several companies of the 26th Engineers over various parts of the area of the Services of Supply, beginning as early as November,

1917. It was not until May, 1918, that the first of the water supply troops reached the front north of Toul; but even so, they were ahead of any American forces operating independently. As the American First Army got under way in its St. Mihiel and Argonne-Meuse operations, a maximum of four companies of the regiment were gathered into that Army, and these, together with a large number of attached troops, formed the Water Supply Service of the First Army.

These Water Supply troops were army troops, that is, army troops as distinguished from the troops of divisions or of army corps. Their work was one of service for the divisions, the corps troops, and the other army troops; in fact, of service for the army as a whole. The head of the service was known as the Water Supply Officer, Army, reporting to the Chief Engineer, Army. This was the position held by the speaker, who in due course became commanding officer of the 26th Engineers in the field.

Water along the front is essentially an *area* matter, that is, water supply installations are ordinarily "tied to the ground," so to speak. Therefore the army area was divided into sectors and these in turn into districts. So far as practicable the districts corresponded to the tactical areas of the corps (composed of a group of divisions). As the front advanced, the districts naturally became extended in depth and the difficulties of covering the territory increased correspondingly.

The *modus operandi* was essentially one of wholesaling water to the tactical organizations, that is, to companies of infantry, batteries of artillery, etc. These organizations called for their water in wholesale at the "water points," that is, points where water was made available to all comers. Beyond the water points the organizations themselves were responsible for the transportation of the water to their own troops, by means of water carts, hand containers, and what not. In general, the water points were spaced so that the maximum travel involved on the part of organizations to the nearest water point would not exceed 1½ miles. Frequently they were spaced more closely.

Likewise, beyond the water point, the responsibility for quality changed. That is, once the water had been taken from the water point, any needed disinfection treatment was incumbent on the Medical Department, through the medical officers attached to the infantry, artillery, etc.

Quite in contrast with the per capita supply of the cantonments in the United States, 55 gallons per man per day, the aim at the front was to provide an average of 2 gallons per man per day. Under conditions of stress, as for instance during the first two days of the St. Mihiel attack, the best that could be offered in certain areas was a little less than 1 gallon per man per day. Animals needed from 8 to 10 gallons per day. Fortunately, in few cases did the animals compete with the troops for water supplies. As far as possible animals were watered from streams and lakes.

The water problems of the St. Mihiel operation exceeded in difficulty those of the Argonne-Meuse operation. Regarding the former, Brigadier General Morrow, as Chief Engineer, First Army, made the statement that of the engineering problems, those of communications and water supply were of primary and parallel importance. The area, as has been stated, is poorly watered, especially during the dry season of the year in which the operation took place. The first consideration of the Water Supply Service was, therefore, to obtain really wet water, and the second, to make that water as pure as practicable.

In the Argonne-Meuse operation, on the other hand, the local water suppplies were greater in number and quantity. There the difficulties lay rather in the necessity for speed in preparing for the initial concentration and in meeting the kaleidoscopic changes resulting from tactical successes.

The functions of the water supply troops included the location and development of sources of supply, such as springs, streams, lakes, dug wells, and bore-holes; the construction of the necessary pumping stations, pipe lines, reservoirs, and water point facilities; the operation of water points, including pumping stations; and the quality control of water. In the operation of pumping stations, the assistance of electrical-mechanical troops was had in the early stages of the campaign, but the tendency later on was to make the Water Supply Service more and more self-dependent along this as well as other lines.

The organization of the Water Supply Service of the First Army, for the purpose of carrying out the above functions, is shown in figure 1. The headquarters of the service were framed around the regimental headquarters of the 26th Engineers and generally were located at First Army Headquarters, along with those of the Chief Engineer, Army. The headquarters included the heads of all departments, excepting only the Sector Water Supply Officers who were in direct field charge. Of purely administrative nature were the positions of Office Manager, Adjutant and Personnel Officer. Among the administrative functions of headquarters was that of maintaining liaison, not merely with the other services and branches of the American First Army, but also with the French Eighth Army on the right and the French Second Army, originally on the left of the American First Army and subsequently, in the Argonne-Meuse operation, entirely displaced by the American First Army.

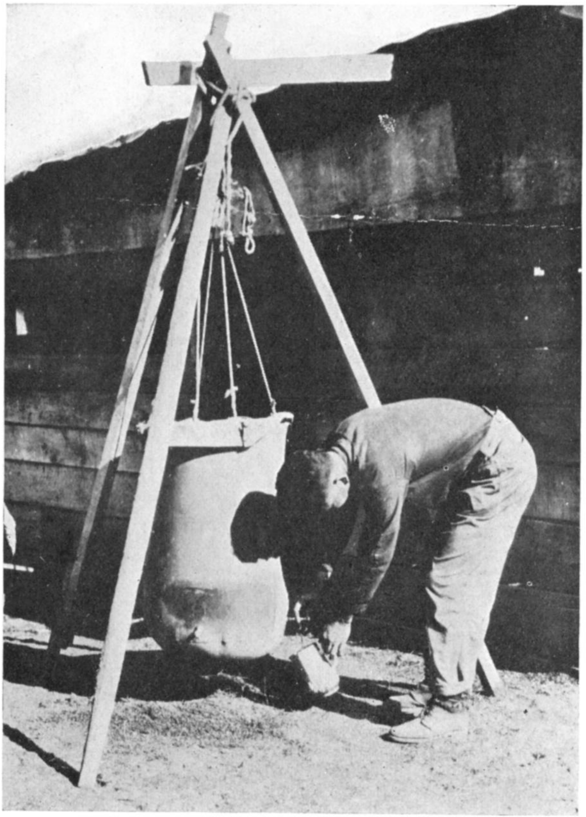

FIG. 2. THE LYSTER BAG

Much of the water "wholesaled" by the Water Supply Service was "retailed" through such bags.

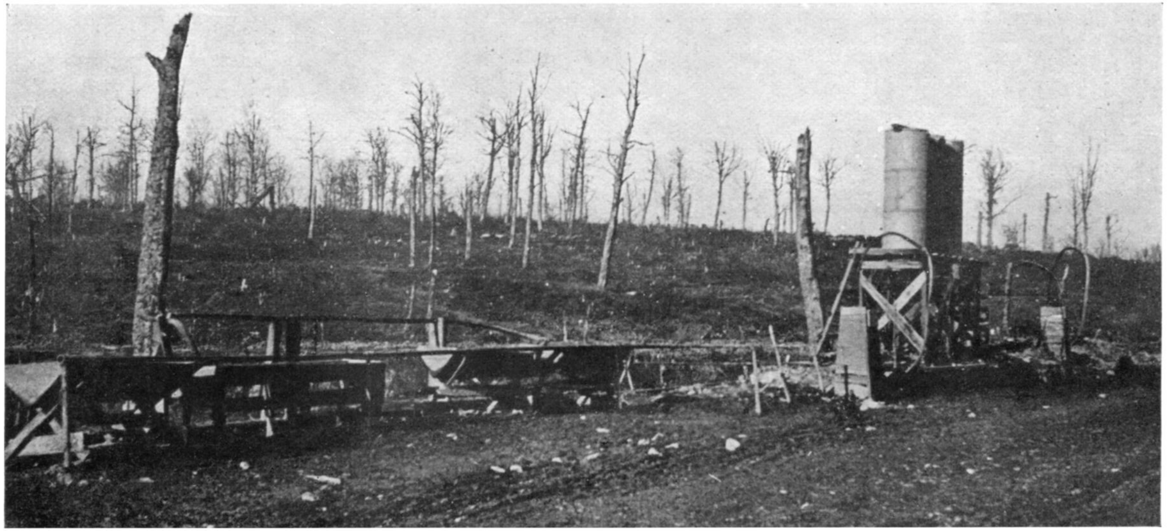

Fig. 3. A Water Point along the Montfaucon-Avocourt road

Here there was limited storage, with facilities for filling water carts and watering animals

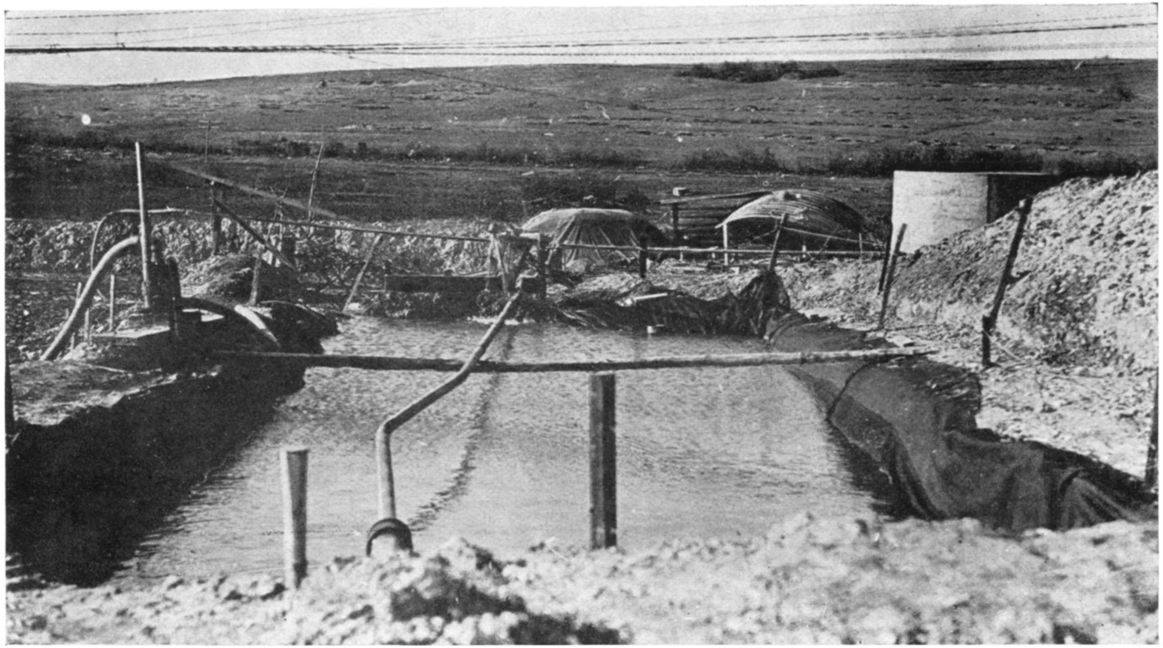

FIG. 4. AN EMERGENCY RESERVOIR WITH CANVAS LINING NEAR MONTFAUCON

This reservoir held 7500 gallons and was filled from a spring by gravity. Many basins of this type were supplied by means of water tank trains (motor).

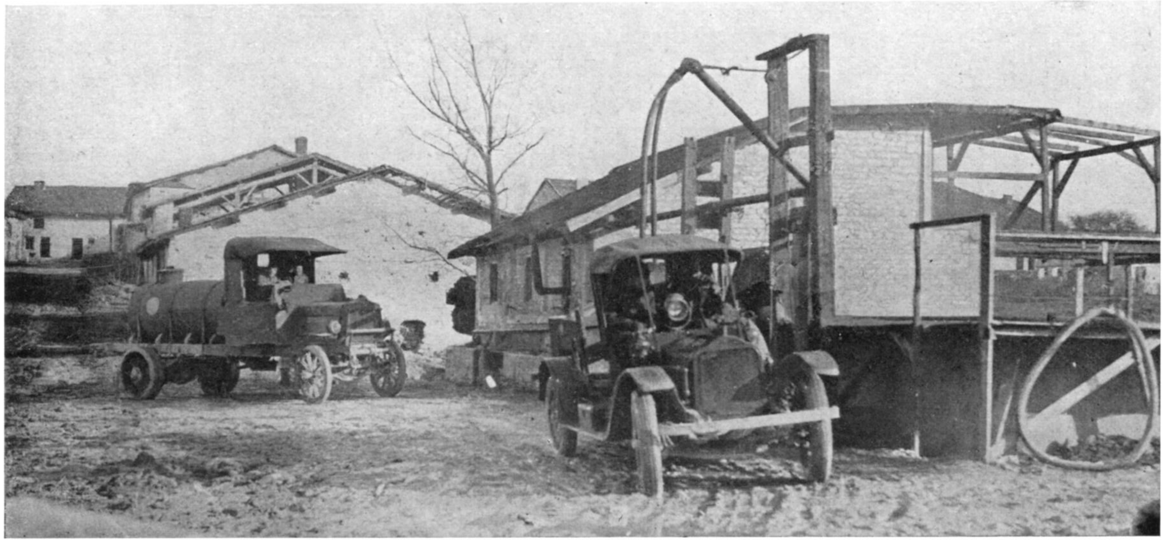

Fig. 5. Motor Tank Trucks at Ivoiry (Argonne Meuse)
A captured German concrete reservoir of 17,000 gallons capacity was utilized here

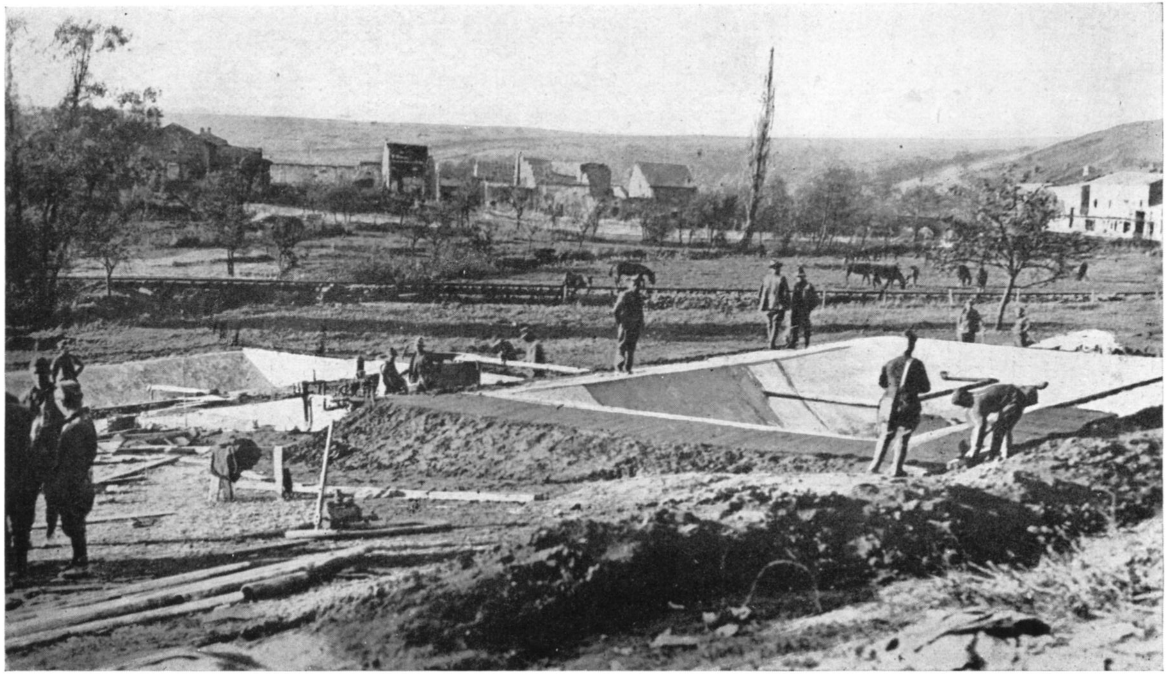

FIG. 6. WATER PURIFICATION PLANT AT EUVEZIN (ST. MIHIEL AREA)

This was one of the most ambitious works at the front of the Water Supply Service

The Reconnaissance or Water Intelligence Department was important in spite of the fact that it was not large. It was most ably headed by Captain Charles H. Lee, 26th Engineers, a member of this Association. It had to do with the obtaining, and making known to proper quarters, of information regarding water supply and water points within our own lines, and also the water supply to be expected or probably most practicable of development once the confronting enemy territory should be taken. Hydrological and geological features received study. The results of the Water Intelligence work were expressed in bulletins and maps. In the latter, especially, some records of high speed production were attained. Thus it became possible to compile during an evening all the information available up to that time: the necessary tracing, lithographing and printing were done during the night; and the maps were ready for distribution early on the following day. This included a 120 kilometer round trip by motor cycle to the lithographing plant.

The Construction Department was naturally of exceeding importance. The Sector Water Supply Officers were in charge of all water supply activities within their sectors, but most of their effort, and that of the troops under them, was devoted to construction. The territorial Districts, as indicated in figure I, were generally in charge of the commanding officer of one of the companies of the 26th Engineers, who had under him his own company plus a company of Pioneer Infantry. Aside from the 26th Engineers the troops which contributed largely to the water supply construction work, under the First Army Water Supply Service, were the 37th Engineers, the 27th Engineers, and 59th Pioneer Infantry.

But construction work could not be carried on without materiel and here frequently was the rub. A supply officer of the Service was overheard to say: "The only things which the Water Supply Service lacks are personnel, materiel, and transportation." The remark was entirely pardonable, for the difficulties were tremendous. The regimental equipment, specified and shipped with great care from the United States, never reached the regiment. It was only the invoices that came to the regiment in France. In spite of the difficulties, however, the water supply "parks" and "dumps," the larger and smaller depots of materiel, were gradually stocked up by the Supply Department of the Service and it became possible to operate at reasonable efficiency. Much materiel was obtained from French sources.

Under the circumstances standardization was necessarily an ideal rather than a reality. The array of pumps was indeed a motley one. The following figures will give an idea of the quantities involved:

For the two larger operations for the First Army, the Water Supply Service received a total of 300 gasoline engine operated pumps and 400 hand pumps. During the months of September and October, 1918, the following quantities of pipe were received from the rear: 1-inch, 82,000 feet; 2-inch, 86,500 feet; 4-inch, 146,000 feet. In the interest of simplification the above three mentioned sizes of pipe were made standard for army use. For the same reason crosses were eliminated from the fittings and also reducers. The latter fact made it proper to say:

> The reducer is dead,
> Long live the bushing.

Where water was lacking locally it was necessary to set up artificial water points. These were supplied by transporting water from other sources of supply. Hence there resulted the Department of Transportation of Water.

At the time of the St. Mihiel operation, for which the need for transportation of water was greatest, the authorized Water Tank Trains (Motor) had not arrived from the States. It, therefore, became necessary to organize Provisional Water Tank Trains, totaling about 80 trucks and 260 men. Among the latter was a motor truck company detailed from the 23d Engineers (the road regiment). In the case of the First Provisional Water Tank Train, cargo tracks were equipped for water carrying by means of closed galvanized iron tanks of about 500 gallons capacity, French wine casks, etc. Its total capacity was about 39,000 gallons. The Second Provisional Water Tank Train was made up by converting, to water hauling use, 34 three-compartment, 750-gallon, gasoline carrying trucks. The latter proved to be even better for the purpose than did the specially designed water tank trucks which arrived later on.

After the beginning of the Argonne-Meuse campaign the 301st and 302d Water Tank Trains (Motor) reached France with part of their equipment and in due course the former came to the First Army front. Its personnel of about 500 was utilized largely in manning the trucks of the Provisional Water Tank Trains.

In addition to transportation by motor tank trucks, water was transported by light railway tank cars. Of these approximately 50 were put into use within the First Army area. The cars were entirely of steel and of 2,000-gallon capacity. They were handled by the Light Railway Service under the direction of the Water Supply Service and proved to be a most useful asset in conveying water not merely for men but also for animals. Especially useful were they in reaching artillery positions in wooded areas into which there penetrated no good highways.

The Department last to be mentioned, but by no means least important, is that of Quality Control, having in charge the quality phases of water supply. Its personnel was drawn from both the Engineer Department and the Sanitary Corps of the Medical Department. The greater number of the officers concerned were sanitary or public health engineers. A number of them, including Captain H. P. Letton, in charge of the quality control work for the First Army during the latter part of the campaign, are members of this Association.

It was the policy to assume that all water found in the field was bad unless proven to be otherwise. Emphasis was, therefore, laid upon the laboratories and upon disinfection. For the former work there were available both mobile field laboratories, arranged on motor trucks, and also portable laboratories. The apparatus and chemicals of the latter were arranged in chests.

In addition to the above mentioned laboratory equipment for bacteriological analyses and for those chemical tests necessary in connection with chlorination, there were available toxicological outfits provided by the Medical Department for use in connection with possibly poisoned waters which might be encountered. It must be said, however, that neither the British, the French, nor our own Army encountered any water which had been poisoned with any intent to deceive, though of course there were many cases of intentional pollution.

Chlorine gas and hypochlorite of lime were the elements upon which principal reliance was placed for disinfection. In addition a certain amount of javellization was done. This is a process, in common use in the French Army and named after its French originator, consisting in the application of a solution of sodium hypochlorite, usually by hand dosing.

The most universally useful piece of equipment was the water purification truck manufactured for the U. S. Army by the Wallace

& Tiernan Company. There were two types of these. The less useful one is known by the trade name of "Chloropump" and contains a pump with an automatic, solution feed, chlorinator. The more useful type,[2] known by the trade name of "Sterilab," includes the pump and chlorinator of the former and in addition a Roberts pressure filter, with alum pot, etc. In addition both types of water purification trucks were equipped with complete laboratory apparatus for bacteriological and chemical work.

Starting on August 17, in preparation for the pending St. Mihiel offensive, with one officer at Army Headquarters and one-half company of troops in the area of the proposed operation, the First Army Water Supply Service reached a total of 1800 men, including 54 officers, for the purpose of that operation. Later the personnel increased to a maximum of 3400 men, including 115 officers. Its personnel was somewhat decreased when the American Second Army was organized and took over the area over which the St. Mihiel operation had taken place, whereas the First Army continued pressing the Argonne-Meuse offensive.

Closely allied with the work of the Water Supply Service was that of the Divisional Sanitary Inspectors of Water, of whom there was one with each division. These officers were sanitary engineers, including for instance 1st Lieutenant P. O. Collins with the 26th Division and Captain L. A. Fritze with the 42d Division, both members of this Association.

Here and there a piece of more ambitious work was carried on. Thus in the last two weeks preceding the St. Mihiel drive there was conceived and constructed in the Foret de Puvennelle a system for supplying water to men and animals secretly concentrated in these large woods, extending well up to the front line. The development included a pumping station constructed in a chamber driven into the rock of a hillside, for protection against enemy shell fire. Two gasoline driven triplex pumps of 60 gallons per minute capacity at 460 feet head were installed, drawing water from a stream at the base of the hillside. A difference in elevation of 300 feet was overcome. The intake arrangement included a coagulation basin and means for automatic chlorination. Approximately six miles of 4-inch and 2-inch pipe lines were installed, together with a number of reservoirs, of which one had a capacity of more than 10,000 gallons, and a system of hydrants for water cart and motor tank train filling, etc. Also horse watering facilities were installed.

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[2] See JOURNAL, September, 1919, p. 562.

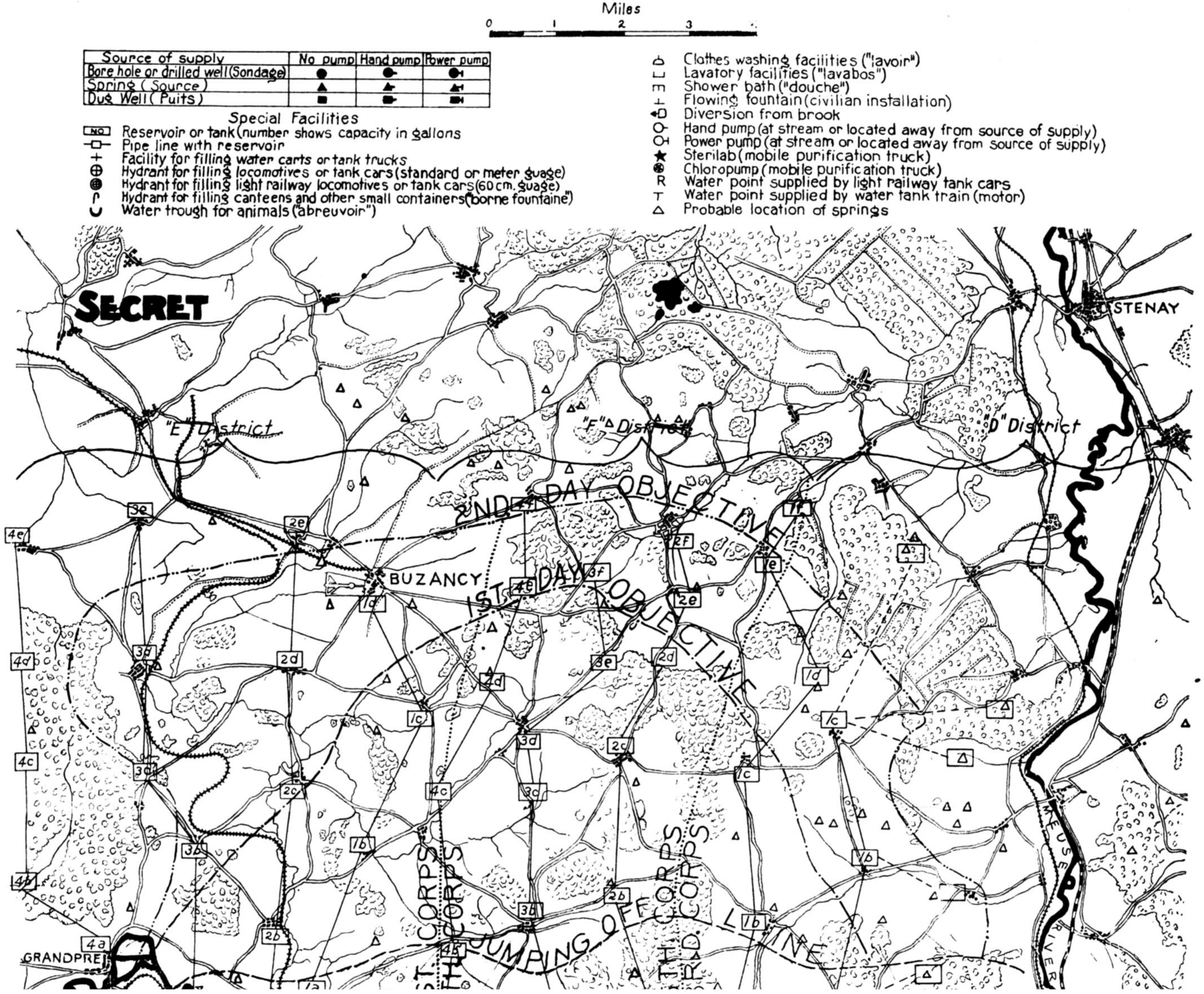
The need for speed, however, was even greater in the Argonne-Meuse operation. Thus the Water Supply Officer, First Army, in common with others of the engineer staff of the Army, received the first notice of the operation on September 11, the day before the St. Mihiel attack. So great was the pressure of the St. Mihiel operation that reconnaissance of the Argonne-Meuse territory could not be begun until September 16; yet all arrangements had to be complete, and were completed, for the first Argonne-Meuse attack by dawn of September 26.

For that operation the American First Army made a marvellous record in the way of troop movement. Hundreds of thousands of men were transported from the St. Mihiel area and from the rear into the new area where until several days before the attack there had been practically only French troops in the front lines. This shifting of troops had to be done at night and with a minimum of available motor transportation. Even in the case of water supply troops, great as was the immediate need in the new area on account of the pending concentration, one of the companies had to spend three nights on the march, passing through bombed territory at that.

For each "drive" the Army Water Supply Service, like all other branches of the army, had its battle plan. Thus figure 7 shows the schematic plan for Water Supply in connection with the culminating Argonne-Meuse attack, that of November 1. The "Districts" indicated are those referred to in Figure 1. For convenience the boundaries between Districts were fixed as north and south lines, thus differing considerably from the army corps boundaries. Immediately following the attack on the morning of November 1, "F" District, for instance, sent forward four advance parties which had previously been posted at positions indicated on the plan as 1a, 2a, 3a and 4a, respectively, near the center of the "jumping off" line.

Each of these parties was composed of about 25 men with a mule-drawn wagon-load of materiel for installing emergency water supplies. Advance Party No. 2, for example, was under orders to set up water points as closely as practicable to positions 2b, 2c, 2d, 2e and 2f. The schematic plan also shows the dispositions to be made, immediately prior to the atttack, of the resources of the Water Supply Service available for the purpose, as regards both materiel and personnel.

Before leaving the subject the speaker desires to pay tribute to

Miles
0
1
2
3
Source of supply
No pump
Hand pump
Power pump
Bore hole or drilled well (Sondage)
Spring (Source)
Dug Well (Puits)
Special Facilities
NO Reservoir or tank (number shows capacity in gallons
Pipe line with reservoir
Facility for filling water carts or tank trucks
Hydrant for filling locomotives or tank cars (standard or meter guage)
Hydrant for filling light railway locomotives or tank cars (60 cm. guage)
Hydrant for filling canteens and other small containers ("borne fountaine")
Water trough for animals ("abreuvoir")
Clothes washing facilities ("lavoir")
Lavatory facilities ("lavabos")
Shower bath ("douche")
Flowing fountain (civilian installation)
Diversion from brook
Hand pump (at stream or located away from source of supply)
Power pump (at stream or located away from source of supply)
Sterilab (mobile purification truck)
Chloropump (mobile purification truck)
R Water point supplied by light railway tank cars
T Water point supplied by water tank train (motor)
Probable location of springs
SECRET
STENAY
"E" District
"F" District
"D" District
BUZANCY
GRANDPRE
MEUSE RIVER
2ND DAY OBJECTIVE
1ST DAY OBJECTIVE
JUMPING OFF LINE
CORPS
CORPS
CORPS
CORPS
4e
3e
2e
1f
2f
3f
4f
1e
2e
3e
4d
3d
2d
2d
1d
2d
1c
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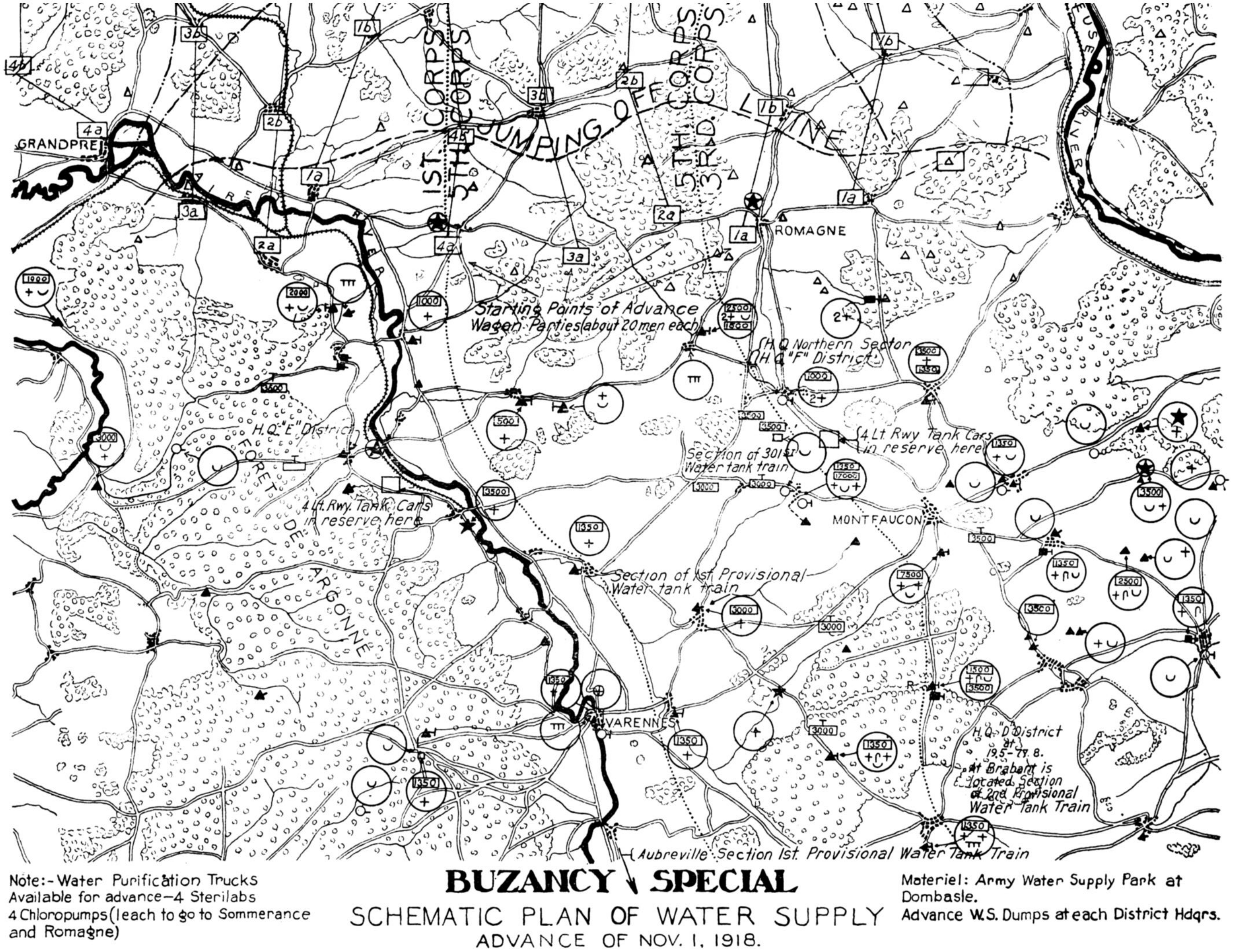
BUZANCY SPECIAL
SCHEMATIC PLAN OF WATER SUPPLY
ADVANCE OF NOV. 1, 1918.
Note:- Water Purification Trucks
Available for advance—4 Sterilabs
4 Chloropumps (1 each to go to Sommerance and Romagne)
Materiel: Army Water Supply Park at Dombasle.
Advance W.S. Dumps at each District Hdqrs.
GRANDPRE
ROMAGNE
MONTFAUCON
VARENNES
MEUSE RIVER
AIRE RIVER
FORET DE ARGONNE
1ST CORPS
3TH CORPS
5TH CORPS
3RD CORPS
JUMPING OFF LINE
Starting Points of Advance Wagon Parties (about 20 men each)
H.Q. Northern Section H.Q. "F" District
H.Q. "E" District
H.Q. "D" District at 19.5-77.8.
At Brabant is located Section of 2nd Provisional Water Tank Train
4 Lt. Rwy. Tank Cars in reserve here
Section of 301st Water tank train
Section of 1st Provisional Water tank train
Aubreville Section 1st Provisional Water Tank Train
1a
1b
2a
2b
3a
3b
4a
4b
1000
2000
3000
3500
1350
500
2500
1600
7500
17000

Fig. 7. Battle Plan for the First Army Water Supply Service in the Culminating Attack on November 1, 1918, of the Argonne-Meuse Drive

the splendid character of the personnel comprising the rank and file of the Water Supply Service. The 26th Engineers alone included members from all states of the Union except two, and, besides, members from Alaska and the Canal Zone. In general the men were real "doughmen" rather than "doughboys," men who knew what

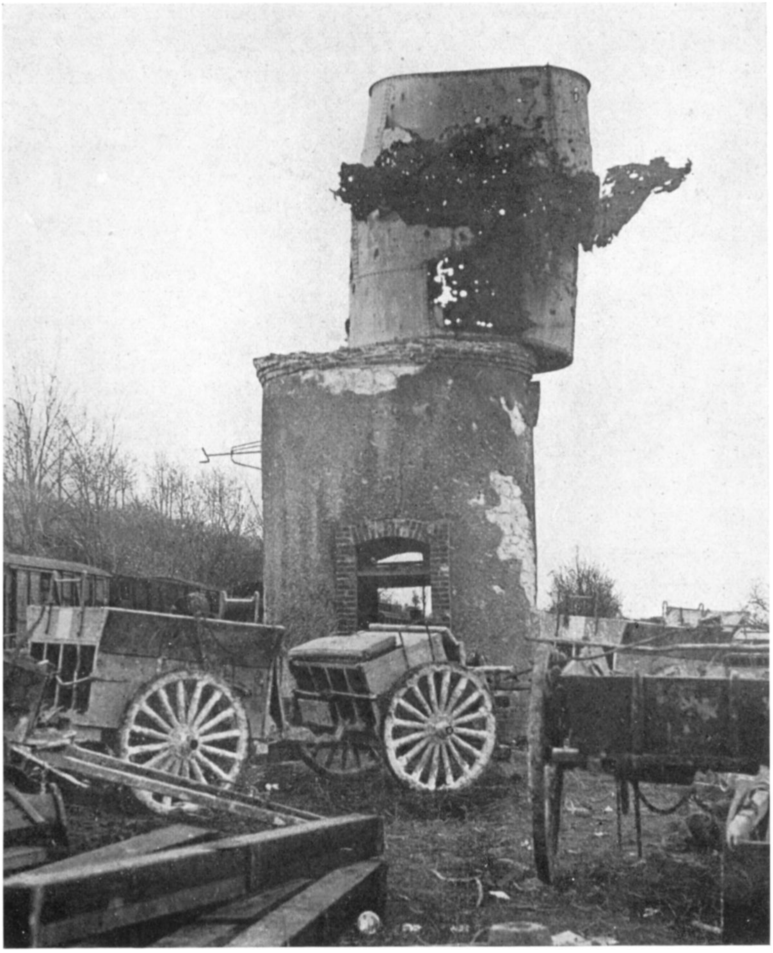

FIG. 8. THE REMAINS OF A FRENCH RAILWAY WATER TANK AT APREMONT (ARGONNE)

This is a view of typical conditions in the battle area, which made emergency installations necessary.

kind of work they were volunteering for, and who were skilled at that work. Especially versatile were the oil field workers from Texas and California.

Though not normally engaged in front line work, yet their positions subjected them to continuing danger and at times their work carried them even into No-man's Land. Like other army troops, they were subjected to hazard without the opportunity to fight back. The greater part of the army water supply work was carried on in the area just ahead of the heavy artillery and just back of the light artillery —an area exposed to frequent enemy shell fire. Even those engaged in the work of quality control were subjected to the hazard. Thus First Lieutenant Joseph Tinsman, Sanitary Corps, Company F, 26th Engineers, was severely wounded on November 4 and gamely fought death until he was forced to succumb November 17, the very day when the American Army of Occupation, including Companies C and F, 26th Engineers, started its march toward the Rhine.

Aside from the above mentioned difficulties there were the hardships due to poor shelter, scarcity of blankets and difficulties in obtaining rations for troops so widely scattered. Infantry divisions would go into the line for days or weeks according to the severity of fighting and then come out and go to the rear for rest. But the First Army troops received no relief whatsoever during the entire campaign. Some of the Water Supply troops were at work on active fronts beginning in the Chateau-Thierry region in August and continuing to the very day of the armistice. The Water Supply troops performed a task which was not easy and, judging by the lack of complaint, performed it well.